DOCUMENT RESUME

ED 067 078 JC 720 210

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TITLE	Instructional Objectives for a Junior College Course in Introduction to Biology.
PUB DATE	72
NOTE	20p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Behavioral Objectives; *Biological Sciences; *Biology; *Biology Instruction; Course Objectives; *Junior Colleges

ABSTRACT

These instructional objectives, written by William Stanley and Norman Rich, have been selected from materials used at Golden West College (California). These objectives are offered simply as samples that may be used where they correspond to the skills, abilities, and attitudes instructors want their students to acquire. These objectives may also serve as models for assisting instructors to translate their courses into specific measurable terms. For other objectives in related courses see: ED 033 686 (Biology [first semester]); and ED 049 748 (General Biology). (MB)

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ED 067078

Instructional Objectives for a Junior College Course in Introduction to Biology

Biology 2A and 2B
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Huntington Beach, California

JC 720 210

UNIVERSITY OF CALIF.
LOS ANGELES

OCT 26 1972

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Leslie Purdy, Compiler
ERIC Clearinghouse for Junior Colleges

1972

INTRODUCTION TO BIOLOGY

BIOLOGY 2A

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BASIC CONCEPTS AND TOOLS

Objectives:

1. Describe, in order, the major steps in a scientific method.

2. Apply the following statistical tools to biological problems:

   a. sum rule
   b. product rule
   c. percent deviation

3. Demonstrate how the statistical tools may be used in a scientific method.

4. Diagram an atom giving the electron orbital position and predict its combining power.

5. List several isotopes occuring in nature.

6. Use fundamental chemical steps or ideas to help explain the possible origin of life.

7. Draw and describe the significance of ionic bonding, covalent and polar covalent bonding.

8. List six (6) major properties of life. Use these properties in defining life.

9. Balance simple reactants to yield stable products.

10. Determine the correct proportions of atoms in common chemical molecules.

11. Apply the principles and concepts given in the lecture to the solution of biological problems and questions.

12. Discuss the DNA molecule in terms of components, molecular shape, and replication.

13. Illustrate and tell the significant information regarding DNA found in Life, October 4, 1963.

14. Show by diagram the bonding relationships between adenine, cytosine, guanine and thymine.

15. List the major theories of life's origin and describe the ideas and contributions, if any.

16. Tell the host relationship between a virus and a bacterium.

17. Define the similarities and differences between the following: diffusion, through a semi-permeable membrane and strength of osmotic solutions.

18. Illustrate how active transport works. How does osmotic pressure affect particle movement.

CELLULAR ACTIVITIES

Objectives:

1. Discuss the chemical and physical concepts regarding photosynthesis.
2. List the major differences and similarities between respiration and photosynthesis.
3. Explain the role of chlorophyll concerning the manufacture of foods by green plants.
4. Show by example, diagram or chemical formulae, how CO_2 and O_2 are involved in cellular respiration.
5. List in order the stages of mitosis from interphase through late telophase and tell the significance of each stage.
6. Diagram mitosis.

CELLS AND TISSUES

Objectives:

1. Label a drawing of a generalized or "typical" cell.
2. Compare a plant and animal cell and list the major similarities and differences.
3. Discuss the major inclusion bodies of a cell and tell their functions.
4. Identify basic kinds of tissue types and list one identifying characteristic.

PLANT ANATOMY

Objectives:

1. List the functions of the major organs, such as roots, stems, leaves, flowers and fruits as given in the workbook.
2. Identify the major kinds of fruit types and methods of seed dispersal.
3. Distinguish between common examples of monocotyledons and dicotyledons.

SUPPORT & LOCOMOTION

Objectives:

1. List and define 10 systems of animals and list the principle organs composing each system.
2. List 10 body cavities and identify the major organs of each.
3. List 6 major functions of the skeletal system.
4. Define two kinds of skeletal systems and state 3 examples of each type and give advantages and disadvantages of each kind.
5. List 5 derivations of integument.
6. List and describe 3 functions of integument.
7. Differentiate between axial and appendicular skeletons.
8. List 3 sexual dimorphisms in human skeletons.
9. List 5 homologous structures of humans and other animals and give their adaptive values in humans.
10. List skeletal modifications of animals which would be necessary in developing from an aquatic environment to land and from a quadrapedal to a bipedal form of locomotion as given on the tape.
11. List 5 analogous structures of humans vs. other animals.

TRANSPORTATION & RESPIRATION

Objectives:

1. Name and label the 15 major structures of the mammal (human) heart, and trace the pathway of blood through the heart.
2. Compare and list the major differences between the mammal, fish, amphibian and reptile.
3. List physiological differences between endothermic and exothermic animals and give 3 advantages of endothermy.
4. Identify musculature tissue of the heart, vein and artery, and give unique characteristics of each.
5. Trace the pathway of blood through the 7 major types of vessels in the body.
6. Name the 3 different types of blood cells, give their function and relative numbers.

TRANSPORTATION & RESPIRATION (cont.)

Objectives:

7. Name the two types of blood fluid and describe the differences between each type.

8. Name the 4 different blood groups and list the possible transfusion possibilities.

9. List the different possible Rh combinations of the fetus, and describe the accompanying problems.

10. Define homograft, autograft, and heterograft and be able to answer objective questions as to how antibody production is associated with transplants.

11. Illustrate or describe malaria blood disorders and sickle cell anemia.

12. Trace the pathway of circulation in plants from leaves to roots, etc.

13. Name the major parts of the respiratory system and trace the pathway of an air molecule from the nose to the blood stream.

14. Describe and give examples of the development of the lung from the gas bladder in fish to the lung in higher animals.

15. Explain the mechanics of respiration and explain the role of CO_2 in regulation of respiratory rate.

16. Differentiate between external and internal respiration and describe oxygen and carbon dioxide transport.

17. Define the lung volumes and determine your own lung capacities with the aid of a wet spirometer.

DIGESTION & EXCRETION

Objectives:

1. Trace the pathway of food from mouth to anus and list 20 major structures along this pathway in the human.

2. Differentiate between the digestive systems of human, hydra, earthworm, planarie and bird and list the major structures of each.

3. Outline the digestive processes of carbohydrates, fats, and proteins in the mouth, stomach, small intestine, and large intestine.

4. Differentiate between fat, carbohydrate, and protein absorption from the small intestine into the blood stream.

DIGESTION & EXCRETION (cont.)

5. Give examples of enzymes and describe the function of enzymes.

6. Trace the pathway of blood through the kidney, and list the major structures involved.

7. List 5 functions of the kidney in humans.

COORDINATION

Objectives:

1. Determine the hormones secreted and the functions of the endocrine glands as listed in the exercise.

2. List at least one (1) hormone deficiency effect regarding the endocrine glands.

3. Give examples of receptors and effectors and describe how they relate to other body systems.

4. Describe the structures and functions of a simple reflex arc.

5. List the functions of the major brain regions.

6. List the similarities and differences between the voluntary and autonomic nervous systems.

7. List the major structures of the human eye.

REPRODUCTION & DEVELOPMENT

Objectives:

1. Differentiate between location and time of occurrence of mitosis and meiosis.

2. List the phases of meiosis and describe or recognize a description of significant changes occurring in each respective phase.

3. Differentiate between mitosis and meiosis concerning significant changes in each phase of cell division.

4. Trace the development (meiotically) of a spermatozoa and ovum.

5. Label and describe the reproductive anatomy of the male and female.

REPRODUCTION & DEVELOPMENT (cont.)

6. Differentiate between sexual and asexual reproduction.

7. List 3 advantages and 1 major disadvantage for asexual reproduction and 1 major advantage for sexual reproduction.

8. Identify a description of 6 different types of asexual reproduction and give an example of each.

9. Identify a description of 3 different types of sexual reproduction and give an example of each.

10. List (4) examples of the asexual reproduction process in plants.

11. List examples of sexual reproductive process in plants.

12. Trace the life cycle of the moss, the general cycle of the flowering plant and the fern.

13. Differentiate between the life cycle of animals and plants.

14. Trace the developments of the zygote until the fetus is formed and list derivatives of the three embryonic germ layers.

GENETICS

Objectives:

1. Work genetic problems, such as mono and dihybrid crosses, sex-linkage and pedigrees.

2. Set up a Punnett square.

3. Solve simple genetic problems for genotype and pheontype ratios.

4. Tell the differences between mitosis and meiosis.

CLASSIFICATION & DISTRIBUTION

Objectives:

1. List three (3) principles affecting evolutionary change.

2. Describe Lamarck's two (2) theories - use and disuse, and inheritance of acquired characteristics.

3. List in order the major units of a classification system, such as, kingdom, phylum, etc.

CLASSIFICATION & DISTRIBUTION (cont.)

4. Describe three (3) major types of isolation regarding speciation.

5. List three (3) migration routes for gene dispersal.

6. List major concepts relating to primary and secondary succession.

ECOLOGY

1. List eleven terrestrial biomes.

2. Describe a food web and food chain.

3. Tell the significance of and define the laws of thermodynamics and Shelford's law.

4. List the major constituents of an eco-system.

5. Define the stability principle.

INTRODUCTION TO BIOLOGY

BIOLOGY 2B

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TAXONOMY AND PLANTS

Objectives:

1. State and name or recognize and name the three basic Rules of Nomenclature.

2. List in order from highest to lowest the plant and animal hierarchy of classification and name each of the taxonomic levels for man.

3. Identify the genus, specific epithet, parenthetic authority and authority, given sample binomial.

4. Determine whether given binomials are valid or invalid based on the Rules of Nomenclature.

5. Prepare a workable dichotomous key using any assortment of non-identical objects.

6. Select and defend any kingdom classification you choose.

7. Spell the names of the seven divisions of algae.

8. Be able to state the differences between any two algal divisions in each of the following characteristics: Special pigments; Food reserves; Reproductive cells and body type.

9. Diagram the three basic reproductive cycles and indicate where meiosis occurs in each cycle.

10. State the major contributions to the science of taxonomy, the century of the contributions and the nationality of each of the following: a) Aristotle; b) Theophrastus; c) John Ray; d) Carolus Linnaeus; e) Charles Darwin; f) Charles Bessey.

11. State the references from which botanical and zoological nomenclature originate.

12. Construct a phylogenetic tree of the divisions of algae and defend the position on the tree assigned each division.

13. Match the orders of fungi with their correct divisions, classes, and common names.

14. Match common viral diseases with the appropriate viral group and the tissues affected.

15. Identify by name and/or illustration the morphological types of bacteria.

16. Correctly label diagrams of the life cycle of wheat rust.

17. Correctly label diagrams of the life cycle of bread mold.

18. State the salient features by which the following groups are set apart: a) algae from fungi; b) thallophytes from higher plants; c) the five divisions of fungi from each other.

19. Use a dichotomous key and identify any specimens provided in the laboratory.

20. State the three morphological types of lichens and determine to which type any unknown specimen belongs.

21. State the types of algae and fungi involved in lichens and the conditions for their involvement.

22. Explain in writing the formation of ascospores and basidiospores.

23. State the genus of the organism associated with each of the following: a) penicillin; b) wheat rust; c) common, edible mushroom; d) LSD; e) the human intestinal bacillus; f)ergot.

24. Diagram a possible phylogenetic tree for the fungi and defend your positioning of each group on the tree.

25. Compare "thallophytes" and "embryophytes" on the bases of the structure of sex organs, type of gametic union, zygote development, the nature of the surface of aerial parts and the body types involved.

26. Match the divisions, classes and common names of the early land plants.

27. Identify specimens of Anthoceros, Marchantia, Mnium, Psilotum, Lycopodium, Selaginella, Equisetum, and Polypodium.

28. Compare liverworts, hornworts, and mosses as to symmetry, leaf characteristics, nature of chloroplasts, sporophytes, rhizoids, and presence or absence of pyrenoids.

29. Prove you have memorized the eras and periods of the geological time table and the number of years ago that each period began.

30. State the salient features by which each of the following are distinguished: a) mosses from liverworts; b) Hepaticae from Anthocerotae; c) Bryophytes from Tracheophytes; d)Psilopsida; e) Lycopsida; f) Sphenopsida; g) Pteropsida; h) Filicineae.

31. Outline, by naming all significant parts and stages, the reproductive cycles of each of the following: a)moss b) Marchantia; c) Psilotum; d) Selaginella;e)fern.

32. State the geologic period and the time in millions of years since the first fossils known of each of the plant divisions were formed.

33. Compute advancement values for flowering plant families.

34. Label the significant parts and stages in the reproductive cycles of pines and of flowering plants.

35. Write the names and the unique characteristics of the classes of gymnosperms in classification outline.

36. Spell and define the following:
a) Ginkgo biloba; b) Cycas; c) megasporophyll; d) plant vivipary;
e) deciduous; f) dioecious; g) monoecious; h) A.K.J. Corda (1809-1849);
i) J. J. Bennett; j) Ephedra; k) Gnetum; l) Welwitschia; m) Pinus;
n) integument; o) pollination droplet; p) micropyle; q) suspensor.

37. List the new features developed by gymnosperms which are of evolutionary significance.

38. Contrast gymnosperms and angiosperms on six separate characteristics.

39. Draw and label correctly all parts of a cyclic, perfect, hypogenous flower cut in mid-vertical section.

40. Examine a flower and determine whether it is:
a. hypogenous, epigenous, perigenous;
b. actinomorphic, zygomorphic;
c. choripetalous, synpetalous, apetalous;
d. spiral or cyclic.

41. State the most primitive order of monocots and dicots.

42. State the most advanced order of monocots and of dicots.

43. Define these terms:
a) coalescence; b) adnation; c) florescence; d) angiosperms;
e) microsporogenesis; f) megasporogenesis.

INVERTEBRATES

Objectives:

1. State or identify the characteristics by which the classes and subclasses of protozoa are distinguished.

2. State the class to which a protozoan belongs when presented with a photograph, drawing, or actual specimen.

3. Label the organelles of a Paramecium, Amoeba or Euglena and state the function of each.

4. State the extent and location of Globigerina ooze and of radiolarian ooze.

5. Recall and spell correctly the etiological agent, its class and the vector of Amoebic dysentery; African sleeping sickness, Type A; Tertian Malaria; and Malignant Malaria.

6. Provide the name of the disease, the etiological agent, the class of the agent or the vector of the diseases in objective number 5 if provided with any one of these items.

7. State the phyla and the level of organization of the organisms in the first three subkingdoms of Animalia.

8. Recognize and name the cell types and spicules of sponges.

9. State which class of protozoa is apt to have given rise to the Sarcodina, Sporozoa, advanced flagellates, ciliates, Porifera, Mesozoa and Metazoa.

10. Describe the feeding and reproduction of sponges.

11. State the significant evolutionary distinctions between the subkingdoms Protozoa, Parazoa, and Metazoa.

12. State the distinctions between the sections Radiata, Protostomia and Deuterostomia.

13. Match the following phyla to their sections and/or subkingdoms;
a) Coelenterata; b) Ctenophora; c) Platyhelminthes; d) Nemertina;
e) Acanthocephala; f) Aschelminthes; g) Entoprocta.

14. Define the words in the derivations list.

15. Relate the evolutionary advancement between the subkingdoms and sections studied since objective 11 to the recapitulation theory.

16. Explain why digestion in Hydra is both extracellular and intracellular.

17. Explain what is meant by the expression, "a gastrula with tentacles".

18. Describe an example of each of the phyla listed in objective # 13.

19. State the significant distinctions between the classes of Coelenterata.

20. State the significant distinctions between the classes of Platyhelminthes.

21. State the distinctions between the classes of Aschelminthes.

22. State the level or organization of each phylum studied after objective 11.

23. State the significant evolutionary distinctions between the Lophophorate phyla and Mollusca.

24. State which phyla are Lophophores.

25. Define the derivation words.

26. State the distinctions between the classes of Mollusca.

27. Use the key to identify specimens of Mollusks.

28. Describe an example of each Lophophorate phylum and each molluskan class.

29. Place a molluskan specimen in its correct class without benefit of keys or other such aids.

30. Define the derivation list.

31. Distinguish the six phyla:
    a. Sipunculida
    b. Echiurida
    c. Pentastomida
    d. Annelida
    e. Onychophora
    f. Tardigrada

32. Distinguish the classes of Annelida.

33. Match each of the following with their annelid class:
    a. sand worm; b. tube worm; c. Palolo worm; d. lug worm; e. Aphrodite; f. Amphitrite; g. Chaetopterus; h. Earthworm; i. rain worm; j. peripitus; k. peripitopsis.

34. State the three subphyla of arthropods as well as the number and names of their body segments.

35. Distinguish the Chelicerata and the Mandibulata on the basis of the types and location of special appendages.

36. Match the names of the classes of Chelicerata with their correct number of legs and ovigers, and which have simple or compound eyes.

37. Match the names of the classes of Mandibulata with the numbers and locations of legs.

38. State which phylum is the largest in terms of numbers of species and about what percent of the animal species are in this phylum.

39. State what features best characterize arthropods.

40. Describe the arthropod cuticle and its molting.

41. Compare the muscular system of arthropods with that of other invertebrates.

42. Describe the fate of the coelomic cavity in arthropods.

43. Compare the coelom with the hemocoel.

44. Describe the means by which arthropods excrete nitrogenous waste. Contrast aquatic and terrestrial arthropods in this regard.

VERTEBRATES

Objectives:

1. Distinguish between chordates and vertebrates.

2. State the major evolutionary distinctions between the classes of extant chordates.

3. Describe the origin of the hinged jaws of vertebrates.

4. Distinguish between and use correctly the words: fish and fishes.

AMPHIBIANS AND REPTILES

Objectives:

1. Name the three orders of the class Amphibia and give their common names.

2. State the anatomical features distinguishing the amphibians from fishes.

3. State the anatomical and physiological features by which zoologists distinguish the orders of amphibians.

4. Define each of the following terms and indicate for each its significance in the structure or function of an amphibian: a. amplexus; b. cloaca; c. nuptial pada; d. poikliothermy.

5. Trace the path of a drop of blood through the circulatory system of a frog.

6. Contrast the structure, function and efficiency of an amphibian heart to that of a mammal.

7. Name the four orders of the class Reptilia.

8. Match each of the following groups to their respective orders: a. lizards; b. snakes; c. turtles; d. terrapins; e. tortoises; f. alligators; g. crocodiles; h. Sphenodon.

9. State the anatomical features distinguishing reptilia from amphibia.

10. State the features by which herpetologists distinguish the orders of reptilia.

11. Identify the three nitrogenous molecules resulting from deamination and match these with the groups of organisms which excrete nitrogenous residues in each of these forms.

12. State the significance of each of the following in amphibian and reptilian evolution: a. amnionic egg; b. Eryops; c. labrynthodonts; d. dinosaurs; e. Seymouria; f. Therapsida; g. thecodonts.

13. Know the only orders of amnionic vertebrates to survive the Cretaceous.

14. Discuss the possible cause of the extinction of dinosaurs.

BIRDS

Objectives:

1. Tell from what geological age the oldest known fossil bird comes and what that bird has been named.

2. List and describe the adaptations evolved by birds which are not known among the reptiles.

3. List and describe adaptations for flight which arose independently (parallel evolution) in the pterosaurs and in birds.

4. Define and explain how each term is related to the study of birds: a. pterodactyl; b. archaeopteryx; c. thecodonts; d. "eye brain"; e. air sacs; f. synsacrum; g. tetrepod.

5. Name the orders of birds to which the following belong; or, match these birds with their orders: a. ducks; b. geese; c. swans; d. hawks; e. vultures; f. pheasants; g. turkeys; h. chickens; i. gulls; j. doves and pigeons; k. owls; l. hummingbirds; m. swifts; n. sparrows; o. mockingbirds; p. finches; q. crows.

6. Know the binomials of each of the following common Southern California birds:
   a. English sparrow - Passer domesticus
   b. house finch - Carpodacus mexicanus
   c. horned lark - Eremophila alpestris
   d. meadow lark - Sturnella neglecta
   e. crow - Cornus brachyrhynchos
   f. mockingbird - Mimus polyglottos
   g. Brewer's blackbird - Euphagus cyanocephalus
   h. mourning dove - Zenaidura macroura
   i. common pigeon - Columba livia
   j. Starling - Sturnus vulgaris
   k. Cliff Swallow - Petrochelidon pyrrhonota

MAMMALS

Objectives:

1. Write a paragraph discussing, "What and when is a mammal?"
2. Discuss the adaptations of mammals involving the skin.
3. List 10 mammalian characteristics of taxonomic significance.
4. Contrast the reproductive and urogenital systems of reptiles vs. mammals.
5. Compare the reproductive structures and habits of monotremes, marsupials, and eutherids.
6. Use the key to the small mammals in owl pellets in Southern California effectively.
7. State what characteristic or feature distinguishes the various orders of mammals.
8. Reproduce the classification system of primates, distinguishing particularly the three suborders of primates, the two infraorders of anthropoids, the two groups of Platyrrhini, the three families of Catarrhini.
9. Contrast the families Pongidae and Hominidae on 12 characteristics.
10. Reproduce the evolutionary trees illustrating primate evolution in general and anthropoid evolution in particular.
11. Define:
    a. "Homo" sapiens
    b. Proconsul africanus
    c. Australopithecus
    d. Homo erectus (Pithecanthropus)
    e. Oreopithecus
    f. Homo sapiens neanderthalensis
    g. Dryopithecus
    h. Propliopithecus
    i. Cro-magnon
12. Effectively use a key to the orders of mammals.
13. Be able to define, match to definitions, give examples or match to examples each of the following:

    1. morphological adaptation
    2. behavioral adaptation
    3. physiological adaptation
    4. individual adaptation
    5. cryptic coloration
    6. warning coloration
    7. mimicry
    8. refrigerator fallacy
    9. Bergmann's Rule
    10. Allen's Rule
    11. Gloger's Rule
    12. competition scramble
    13. competition contests
    14. emigration

15. immigration
16. migration
17. habitat
18. niche
19. ectocrine
20. geographic isolation
21. ecological isolation
22. sexual isolation
23. genetic isolation
24. divergence evolution
25. convergent evolution
26. parallel evolution
27. neoteny
28. macroevolution
29. orthogenesis